TVS3300 33V 平缓钳位浪涌保护器件

1 特性

- 保护特性符合针对工业信号线路的 1kV、42Ω IEC 61000-4-5 浪涌测试要求
- 35A、8/20μs 浪涌电流下的最大钳位电压为 40V
- 关态电压：33V
- 微型 1.1mm^2 WCSP 和 4mm^2 SON 封装
- 在 125°C 时，可耐受超过 4,000 次的 30A 8/20μs 浪涌电流的重复冲击
- 强大的浪涌保护
  - IEC61000-4-5 (8/20μs)：35A
  - IEC61643-321 (10/1000μs)：4A
- 低泄漏电流
  - 27°C 下为 19nA（典型值）
  - 85°C 下为 28nA（典型值）
- 低电容：130pF
- 集成 4 级 IEC 61000-4-2 ESD 保护

2 应用

- 工业传感器
- PLC I/O 模块
- 24V 电源线或数字开关线
- 4/20mA 环路
- 电器
- 医疗设备
- 电机驱动器

3 说明

TVS3300 可将高达 35A 的 IEC 61000-4-5 故障电流进行可靠分流，以保护系统免受高功率瞬态冲击或雷击。该器件为满足常见的工业信号线路 EMC 要求提供了解决方案，可通过 42Ω 电阻进行耦合的方式承受最高 1kV IEC 61000-4-5 开路电压。TVS3300 使用独特的反馈机制确保在故障期间发挥精确的平缓钳位能力，保证系统接触电压低于 40V。精确的电压调节允许设计人员放心地选择具有较低电压容差的系统组件，不但减少了系统成本和复杂度，而且不损害可靠性。

此外，TVS3300 还采用 1mm × 1.1mm WCSP 和 2mm × 2mm SON 封装，非常适用于空间受限的 应用，与业内标准的 SMA 和 SMB 封装相比，尺寸减小高达 90%。极低的器件泄露电流和电容确保最大限度地降低了对受保护线路的影响。为了确保在产品的整个寿命期间提供可靠保护，TI 在高温环境下对 TVS3300 进行了 4000 次重复浪涌冲击测试，但器件性能未发生任何变化。

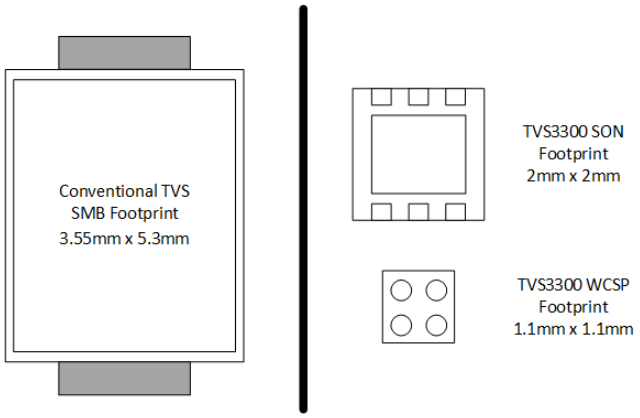
TVS3300 是 TI 的平缓钳位系列浪涌器件中的一款产品。有关该系列的其他器件的更多信息，请参阅*器件比较表*

设备信息(1)

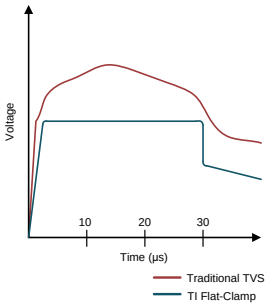
器件型号	封装	封装尺寸（标称值）
TVS3300	WCSP (4)	1.062mm × 1.116mm
	SON (6)	2.00mm × 2.00mm

(1) 如需了解所有可用封装，请参阅数据表末尾的可订购产品附录。

封装比较



对 8/20μs 浪涌事件的电压钳位响应



An IMPORTANT NOTICE at the end of this data sheet addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers. PRODUCTION DATA.

目录

1 特性 ... 1
2 应用 ... 1
3 说明 ... 1
4 修订历史记录 ... 2
5 **Device Comparison Table** ... 3
6 **Pin Configuration and Functions** ... 4
7 **Specifications** ... 5
7.1 Absolute Maximum Ratings ... 5
7.2 ESD Ratings - JEDEC ... 5
7.3 ESD Ratings - IEC ... 5
7.4 Recommended Operating Conditions ... 5
7.5 Thermal Information ... 5
7.6 Electrical Characteristics ... 6
7.7 Typical Characteristics ... 7
8 **Detailed Description** ... 9
8.1 Overview ... 9
8.2 Functional Block Diagram ... 9
8.3 Feature Description ... 9
8.4 Reliability Testing ... 9
8.5 Device Functional Modes ... 9
9 **Application and Implementation** ... 11
9.1 Application Information ... 11
9.2 Typical Application ... 11
10 **Power Supply Recommendations** ... 12
11 **Layout** ... 13
11.1 Layout Guidelines ... 13
11.2 Layout Example ... 13
12 器件和文档支持 ... 15
12.1 文档支持 ... 15
12.2 接收文档更新通知 ... 15
12.3 社区资源 ... 15
12.4 商标 ... 15
12.5 静电放电警告 ... 15
12.6 Glossary ... 15
13 机械、封装和可订购信息 ... 15

4 修订历史记录

Changes from Revision B (April 2017) to Revision C **Page**

- 修订数据表以符合其他 TVSxx00 系列器件的要求 ... 1

Changes from Revision A (March 2017) to Revision B **Page**

- Updated standard for (10/1000 μs) from IEC 61000-4-5 to IEC 61643-321 in the *Absolute Maximum Ratings* table ... 5

Changes from Original (Feb 2017) to Revision A **Page**

- 已添加 SON 封装选项 ... 1
- 已添加 在*特性* 部分中添加 ±11kV 接触放电 (SON) ... 1
- Added Peak pulse—clamping direction specs for SON package in the *Absolute Maximum Ratings* table ... 5
- Added IEC 61000-4-2 contact discharge spec for SON package in the *ESD Ratings - IEC* table ... 5
- Added T_A = 27°C condition to dynamic resistance in the *Electrical Characteristics* table ... 5

Copyright © 2017–2018, Texas Instruments Incorporated

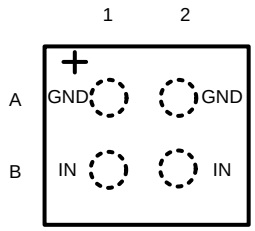
5 Device Comparison Table

Device	V_{rwm}	V_{clamp} at I_{pp}	I_{pp} (8/20 µs)	V_{rwm} leakage (nA)	Package Options	Polarity
TVS0500	5	9.2	43	0.07	SON	Unidirectional
TVS1400	14	18.4	43	2	SON	Unidirectional
TVS1800	18	22.8	40	0.5	SON	Unidirectional
TVS2200	22	27.7	40	3.2	SON	Unidirectional
TVS2700	27	32.5	40	1.7	SON	Unidirectional
TVS3300	33	38	35	19	WCSP, SON	Unidirectional

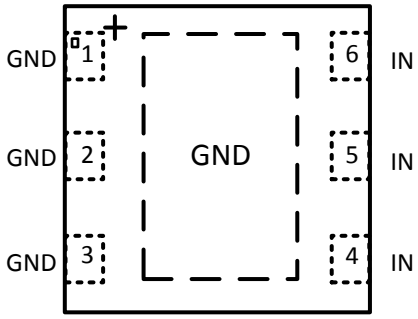
Copyright © 2017–2018, Texas Instruments Incorporated

6 Pin Configuration and Functions

YZF Package
4-Pin WCSP
Top View



DRV Package
6-Pin SON
Top View



Pin Functions

PIN			TYPE	DESCRIPTION
NAME	YZF	DRV		
IN	B1, B2	4, 5, 6	I	ESD and surge protected channel
GND	A1, A2	1, 2, 3, exposed thermal pad	GND	Ground

Copyright © 2017–2018, Texas Instruments Incorporated

7 Specifications

7.1 Absolute Maximum Ratings

T_A = 27℃ (unless otherwise noted)(1)

		MIN	MAX	UNIT
Maximum Surge	IEC 61000-4-5 Current (8/20 µs)		35	A
	IEC 61000-4-5 Power (8/20 µs)		1330	W
	IEC 61643-321 Current (10/1000 µs) - WCSP		4	A
	IEC 61643-321 Power (10/1000 µs) - WCSP		150	W
	IEC 61643-321 Current (10/1000 µs) - DRV		3.5	A
	IEC 61643-321 Power (10/1000 µs) - DRV		125	W
Maximum Forward Surge	IEC 61000-4-5 Current (8/20 µs)		50	A
	IEC 61000-4-5 Power (8/20 µs)		80	W
	IEC 61643-321 Current (10/1000 µs)		23	A
	IEC 61643-321 Power (10/1000 µs)		60	W
EFT	IEC 61000-4-4 EFT Protection		80	A
I_{BR}	DC Breakdown Current - DRV		10	mA
I_F	DC Forward Current		500	mA
T_A	Ambient Operating Temperature	-40	125	°C
T_{stg}	Storage Temperature	-65	150	°C

(1) Stresses beyond those listed under *Absolute Maximum Rating* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Condition*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

7.2 ESD Ratings - JEDEC

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins(1)	±2000	V
		Charged device model (CDM), per JEDEC specification JESD22-C101, all pins(2)	±500	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

7.3 ESD Ratings - IEC

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	IEC 61000-4-2 contact discharge	±11	kV
		IEC 61000-4-2 air-gap discharge	±30	

7.4 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

PARAMETER		MIN	NOM	MAX	UNIT
V_{RWM}	Reverse Stand-off Voltage		33		V

7.5 Thermal Information

THERMAL METRIC(1)		TVS3300		UNIT
		YZF (WCSP)	DRV (SON)	
		4 PINS	6 PINS	
R_{qJA}	Junction-to-ambient thermal resistance	173.8	70.4	°C/W
$R_{qJC(top)}$	Junction-to-case (top) thermal resistance	1.7	73.7	°C/W

(1) For more information about traditional and new thermal metrics, see the Semiconductor and IC Package Thermal Metrics application report.

Copyright © 2017–2018, Texas Instruments Incorporated

Thermal Information (continued)

THERMAL METRIC(1)		TVS3300		UNIT
		YZF (WCSP)	DRV (SON)	
		4 PINS	6 PINS	
R_{qJB}	Junction-to-board thermal resistance	47.1	40	°C/W
Y_{JT}	Junction-to-top characterization parameter	9.5	2.2	°C/W
Y_{JB}	Junction-to-board characterization parameter	47.1	40.3	°C/W
$R_{qJC(bot)}$	Junction-to-case (bottom) thermal resistance	N/A	11	°C/W

7.6 Electrical Characteristics

over operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
I_{LEAK}	Leakage Current	Measured at $V_{IN} = V_{RWM}$, T_A = 27°C		19	150	nA
		Measured at $V_{IN} = V_{RWM}$, T_A = 85°C		28	600	nA
V_F	Forward Voltage	I_{IN} = 1 mA from GND to IO	0.25	0.5	0.65	V
V_{BR}	Break-down Voltage	I_{IN} = 1 mA from IO to GND	34	35.8	39	V
V_{FCLAMP}	Forward Clamp Voltage	35 A IEC 61000-4-5 Surge (8/20 µs) from GND to IO, 27°C	1	2	5	V
V_{CLAMP}	Clamp Voltage	15 A IEC 61000-4-5 Surge (8/20 µs) from IO to GND, V_{IN} = 0 V before surge, 27°C	34	37	40	V
		35 A IEC 61000-4-5 Surge (8/20 µs) from IO to GND, V_{IN} = 0 V before surge, 27°C	34	38	40	V
R_{DYN}	8/20 µs surge dynamic resistance	Calculated from V_{CLAMP} at 15 A and 30 A surge current levels, 27°C		40	60	mΩ
C_{IN}	Input pin capacitance	V_{IN} = 12 V, f = 1 MHz, 30 mV_{pp}, IO to GND	110	130	150	pF
SR	Maximum Slew Rate	0-V_{RWM} rising edge, sweep rise time and measure slew rate when I_{PEAK} = 1 mA, 27°C		2.5		V/µs
		0-V_{RWM} rising edge, sweep rise time and measure slew rate when I_{PEAK} = 1 mA, 105°C		0.7		V/µs

版权 © 2017–2018, Texas Instruments Incorporated

7.7 Typical Characteristics

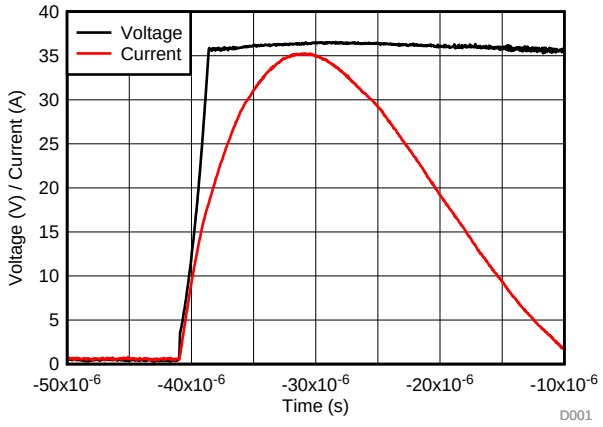


图 1. 8/20 µs Surge Response at 35 A

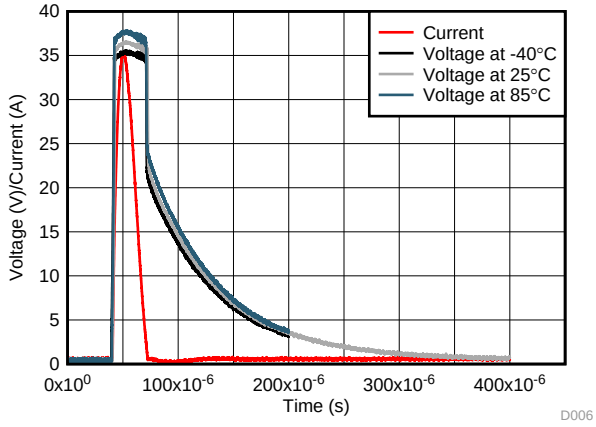
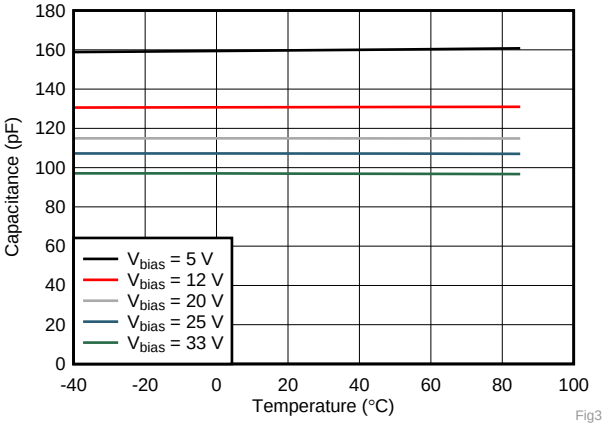


图 2. 8/20 µs Surge Response at 35 A Across Temperature



f = 1 MHz, 30 mVpp, IO to GND

图 3. Capacitance vs Temperature Across Bias

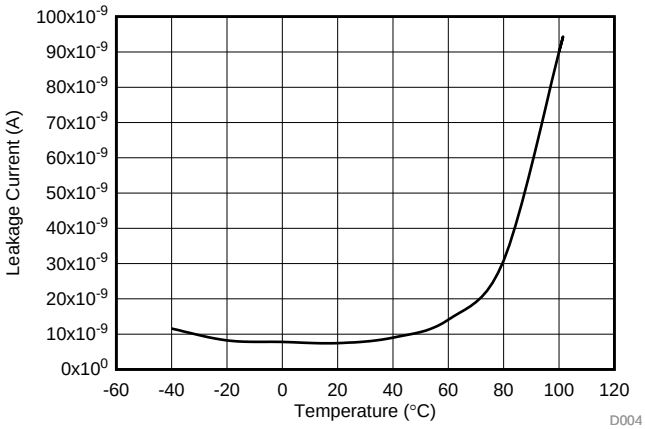


图 4. Leakage Current vs Temperature at 33 V

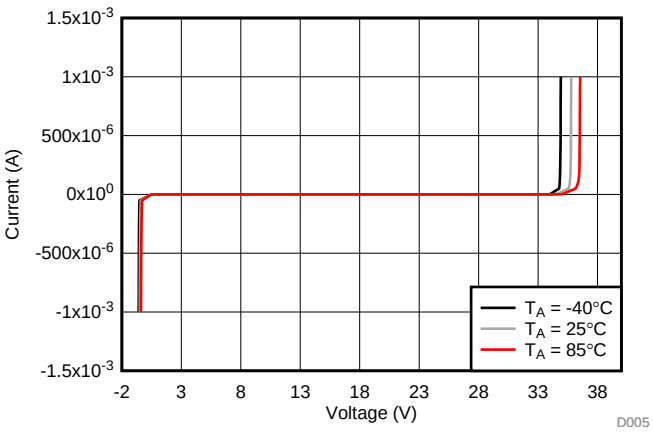


图 5. I/V Curve Across Temperature

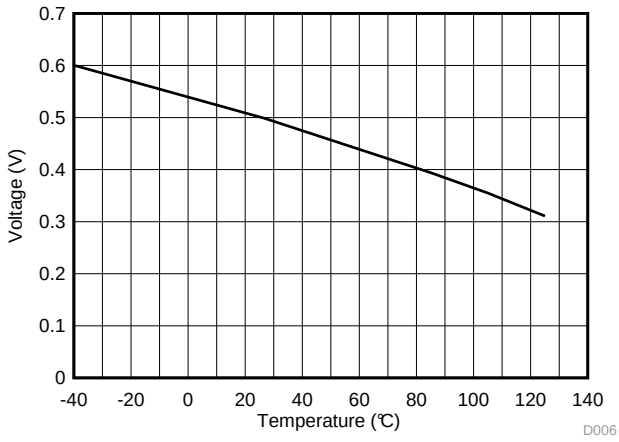


图 6. Forward Voltage vs Temperature

Typical Characteristics (接下页)

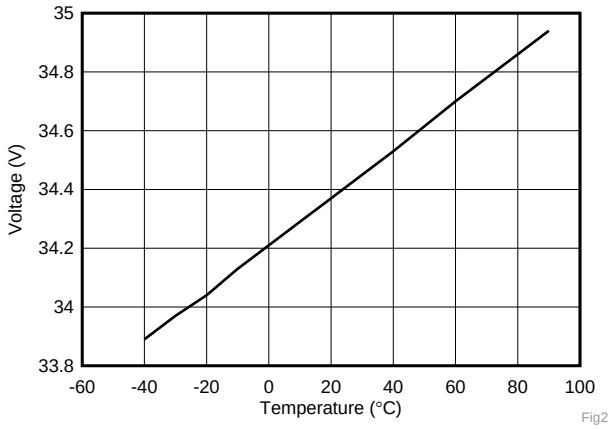


图 7. Breakdown Voltage (1 mA) vs Temperature

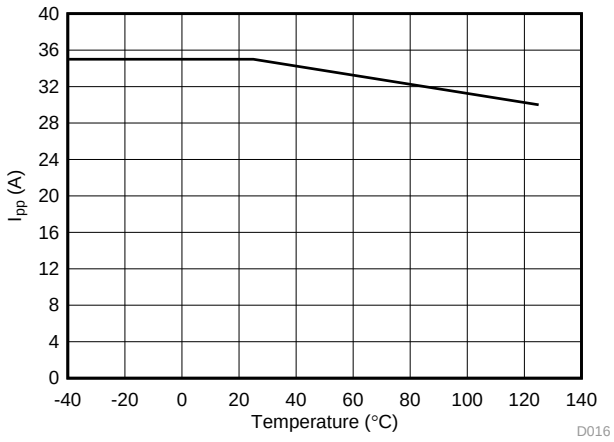


图 8. Max Surge Current (8/20 µs) vs Temperature

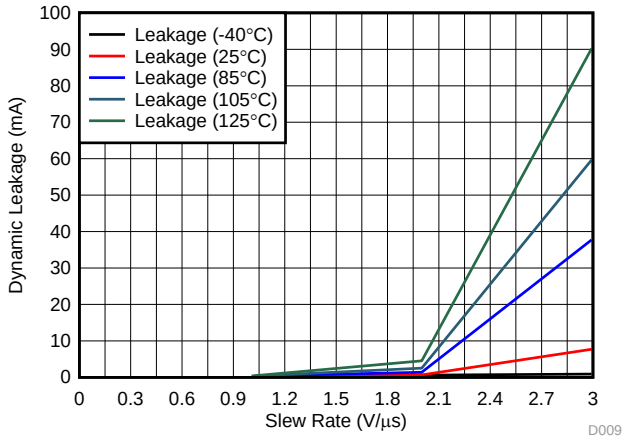


图 9. Dynamic Leakage vs Signal Slew Rate across Temperature

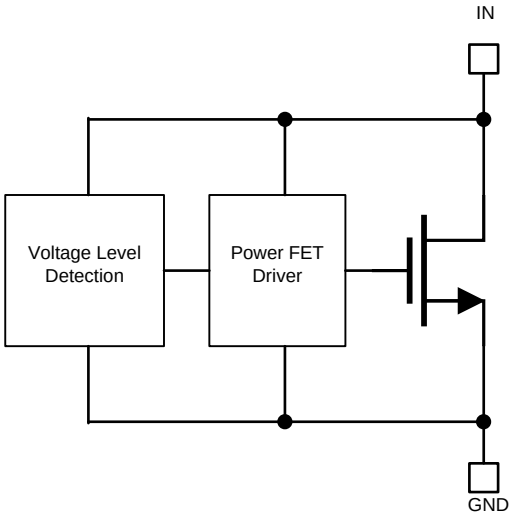
版权 © 2017–2018, Texas Instruments Incorporated

8 Detailed Description

8.1 Overview

The TVS3300 is a precision clamp with a low, flat clamping voltage during transient overvoltage events like surge and protecting the system with zero voltage overshoot.

8.2 Functional Block Diagram



Copyright © 2017, Texas Instruments Incorporated

8.3 Feature Description

The TVS3300 is a precision clamp that handles 35 A of IEC 61000-4-5 8/20 µs surge pulse. The flat clamping feature helps keep the clamping voltage very low to keep the downstream circuits from being stressed. The flat clamping feature can also help end-equipment designers save cost by opening up the possibility to use lower-cost, lower voltage tolerant downstream ICs. The TVS3300 has minimal leakage under the standoff voltage of 33 V, making it an ideal candidate for applications where low leakage and power dissipation is a necessity. IEC 61000-4-2 and IEC 61000-4-4 ratings make it a robust protection solution for ESD and EFT events. Wide ambient temperature range of –40°C to +125°C a good candidate for most applications. Compact packages enable it to be used in small devices and save board area.

8.4 Reliability Testing

To ensure device reliability, the TVS3300 is characterized against 4000 repetitive pulses of 30 A IEC 61000-4-5 8/20 µs surge pulses at 125°C. The test is performed with less than 10 seconds between each pulse at high temperature to simulate worst case scenarios for fault regulation. After each surge pulse, the TVS3300 clamping voltage, breakdown voltage, and leakage are recorded to ensure that their is no variation or performance degradation. By ensuring robust, reliable, high temperature protection, the TVS3300 enables fault protection in applications that must withstand years of continuous operation with no performance change.

8.5 Device Functional Modes

8.5.1 Protection Specifications

The TVS3300 is specified according to both the IEC 61000-4-5 and IEC 61643-321 standards. This enables usage in systems regardless of which standard is required in relevant product standards or best matches measured fault conditions. The IEC 61000-4-5 standards requires protection against a pulse with a rise time of 8 µs and a half length of 20 µs, while the IEC 61643-321 standard requires protection against a much longer pulse with a rise time of 10 µs and a half length of 1000 µs.

Device Functional Modes (接下页)

The positive and negative surges are imposed to the TVS3300 by a combinational waveform generator (CWG) with a 2-Ω coupling resistor at different peak voltage levels. For powered on transient tests that need power supply bias, inductances are usually used to decouple the transient stress and protect the power supply. The TVS3300 is post tested by assuring that there is no shift in device breakdown or leakage at V_{rwm}.

In addition, the TVS3300 has been tested according to IEC 61000-4-5 to pass a ±1 kV surge test through a 42-Ω coupling resistor and a 0.5 µF capacitor. This test is a common test requirement for industrial signal I/O lines and the TVS3300 will serve an ideal protection solution for applications with that requirement.

The TVS3300 allow integrates IEC 61000-4-2 level 4 ESD Protection and 80 A of IEC 61000-4-4 EFT Protection. These combine to ensure that the device can protect against most transient conditions regardless of length or type.

For more information on TI's test methods for Surge, ESD, and EFT testing, reference TI's IEC 61000-4-x Testing Application Note

8.5.2 Minimal Derating

Unlike traditional diodes the TVS3300 has very little derating of max power dissipation and ensures robust performance up to 125°C, shown in 图 8. Traditional TVS diodes lose up to 50% of their current carrying capability when at high temperatures, so a surge pulse above 85°C ambient can cause failures that are not seen at room temperature. The TVS3300 prevents this and ensures that you will see the same level of protection regardless of temperature.

8.5.3 Transient Performance

During large transient swings, the TVS3300 will begin clamping the input signal to protect downstream conditions. While this prevents damage during fault conditions, it can cause leakage when the intended input signal has a fast slew rate. In order to keep power dissipation low and remove the chance of signal distortion, it is recommended to keep the slew rate of any input signal on the TVS3300 below 2.5 V/µs at room temperature and below 0.7 V/µs at 125°C shown in 图 9. Faster slew rates will cause the device to clamp the input signal and draw current through the device for a few microseconds, increasing the rise time of the signal. This will not cause any harm to the system or to the device, however if the fast input voltage swings occur regularly it can cause device overheating.

版权 © 2017–2018, Texas Instruments Incorporated

9 Application and Implementation

注

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

9.1 Application Information

The TVS3300 can be used to protect any power, analog, or digital signal from transient fault conditions caused by the environment or other electrical components.

9.2 Typical Application

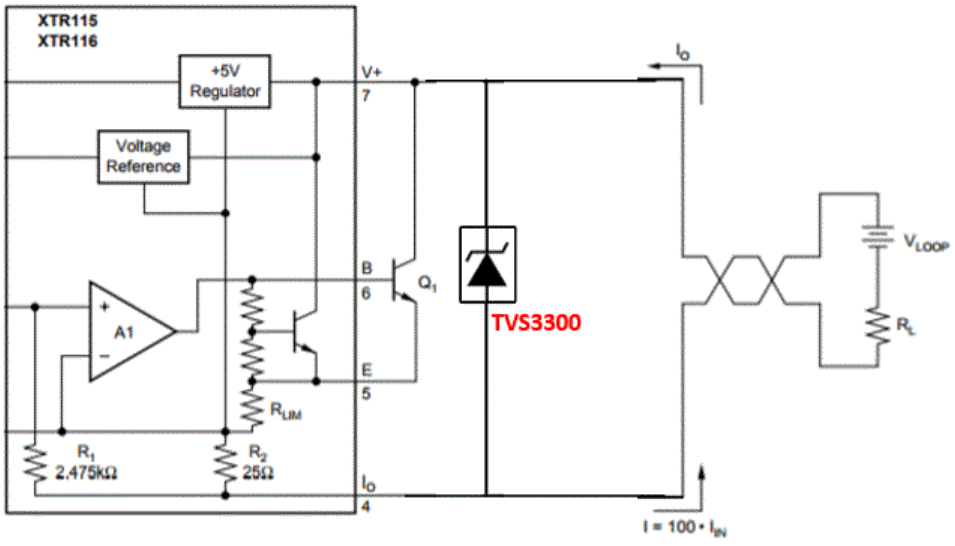


图 10. TVS3300 Application Schematic

9.2.1 Design Requirements

A typical operation for the TVS3300 would be protecting an analog output module on a PLC similar to 图 10. In this example, the TVS3300 is protecting a 4-20 mA transmitter that uses the XTR115, a standard transmitter that has a nominal voltage of 24 V and a maximum input voltage of 40 V. Most industrial interfaces such as this require protection against ±1 kV surge test through a 42-Ω coupling resistor and a 0.5 µF capacitor, equaling roughly 24 A of surge current. Without any input protection, if a surge event is caused by lightning, coupling, ringing, or any other fault condition this input voltage will rise to hundreds of volts for multiple microseconds, violating the absolute maximum input voltage and harming the device. An ideal surge protection diode will maximize the useable voltage range while still clamping at a safe level for the system, TI's Flat-Clamp technology provides the best protection solution.

9.2.2 Detailed Design Procedure

If the TVS3300 is in place to protect the device, during a surge event the voltage will rise to the breakdown of the diode at 35.8 V, and then the TVS3300 will turn on, shunting the surge current to ground. With the low dynamic resistance of the TVS3300, large amounts of surge current will have minimal impact on the clamping voltage. The dynamic resistance of the TVS3300 is around 40 mΩ, which means 24 A of surge current will cause a voltage raise of 24 A × 40 mΩ = 0.96 V. Because the device turns on at 35.8 V, this means the XTR115 input will be exposed to a maximum of 35.8 V + 0.96 V = 36.76 V during surge pulses, well within the absolute maximum input voltage. This ensures robust protection of your circuit.

Typical Application (接下页)

The small size of the device also improves fault protection by lowering the effect of fault current coupling onto neighboring traces. The small form factor of the TVS3300 allows the device to be placed extremely close to the input connector, lowering the length of the path fault current will take through the system compared to larger protection solutions.

Finally, the low leakage of the TVS3300 will have low input power losses. At 33 V, the device will see typical 19 nA leakage for a constant power dissipation of less than 100 µW, a small quantity that will minimally effect overall efficiency metrics and heating concerns.

9.2.3 PLC Surge Protection Reference Design

For a detailed description of the TVS3300 advantages in a PLC Analog Input Module, reference TI's Surge Protection Reference Design for PLC Analog Input Module This document describes the considerations and performance of the TVS3300 in a common industrial application.

9.2.4 Configuration Options

The TVS3300 can be used in either unidirectional or bidirectional configuration. By placing two TVS3300's in series with reverse orientation bidirectional operation can be used, allowing a working voltage of ±33 V. TVS3300 operation in bidirectional will be similar to unidirectional operation, with a minor increase in breakdown voltage and clamping voltage. The TVS3300 bidirectional performance has been characterized in the TVS3300 Configurations Characterization.

10 Power Supply Recommendations

The TVS3300 is a clamping device so there is no need to power it. To ensure the device functions properly do not violate the recommended V_{IN} voltage range (0 V to 33 V) .

版权 © 2017–2018, Texas Instruments Incorporated

11 Layout

11.1 Layout Guidelines

The optimum placement is close to the connector. EMI during an ESD event can couple from the trace being struck to other nearby unprotected traces, resulting in early system failures. The PCB designer must minimize the possibility of EMI coupling by keeping any unprotected traces away from the protected traces which are between the TVS and the connector.

Route the protected traces straight.

Eliminate any sharp corners on the protected traces between the TVS3300 and the connector by using rounded corners with the largest radii possible. Electric fields tend to build up on corners, increasing EMI coupling.

11.2 Layout Example

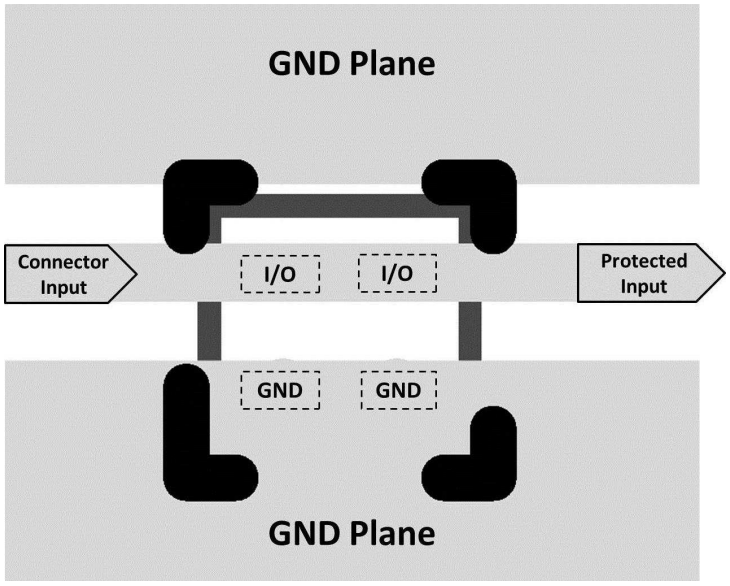


图 11. TVS3300 WCSP Layout

Layout Example (接下页)

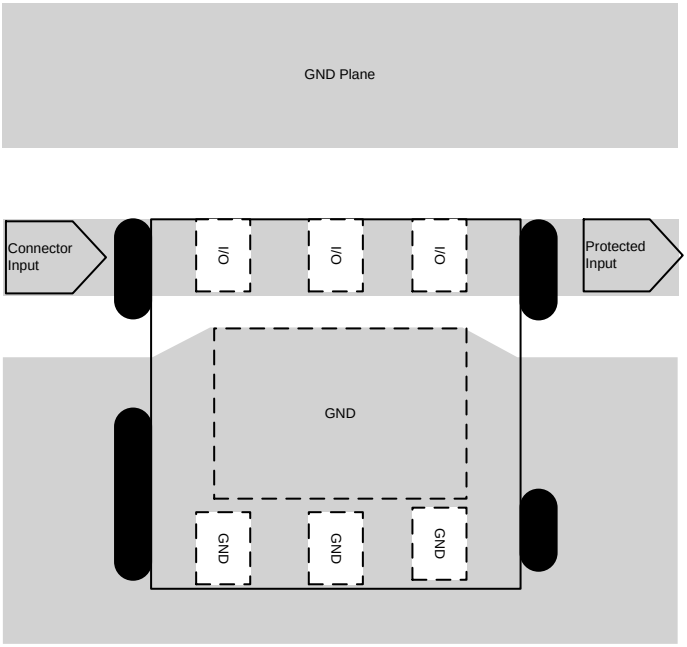


图 12. TVS3300 SON Layout

版权 © 2017–2018, Texas Instruments Incorporated

12 器件和文档支持

12.1 文档支持

12.1.1 相关文档

如需相关文档，请参阅：

- *平缓钳位 TVS 评估套件*
- 适用于 PLC 模拟输入模块的浪涌保护参考设计
- *《TVS3300 评估模块用户指南》*
- *《TVS3300DRV 评估模块用户指南》*

12.2 接收文档更新通知

要接收文档更新通知，请导航至 TI.com 上的器件产品文件夹。请单击右上角的*提醒我* 进行注册，即可每周接收产品信息更改摘要。有关更改的详细信息，请查看任何已修订文档中包含的修订历史记录。

12.3 社区资源

下列链接提供到 TI 社区资源的连接。链接的内容由各个分销商“按照原样”提供。这些内容并不构成 TI 技术规范，并且不一定反映 TI 的观点；请参阅 TI 的 《使用条款》。

TI E2E™ 在线社区 ***TI 的工程师对工程师 (E2E) 社区。*** **此社区的创建目的在于促进工程师之间的协作。在 e2e.ti.com 中，您可以咨询问题、分享知识、拓展思路并与同行工程师一道帮助解决问题。**

设计支持 ***TI 参考设计支持*** **可帮助您快速查找有帮助的 E2E 论坛、设计支持工具以及技术支持的联系信息。**

12.4 商标

E2E is a trademark of Texas Instruments.

12.5 静电放电警告



ESD 可能会损坏该集成电路。德州仪器 (TI) 建议通过适当的预防措施处理所有集成电路。如果不遵守正确的处理措施和安装程序，可能会损坏集成电路。

ESD 的损坏小至导致微小的性能降级，大至整个器件故障。 精密的集成电路可能更容易受到损坏，这是因为非常细微的参数更改都可能会导致器件与其发布的规格不相符。

12.6 Glossary

SLYZ022 — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

13 机械、封装和可订购信息

以下页面包含机械、封装和可订购信息。这些信息是指定器件的最新可用数据。数据如有变更，恕不另行通知和修订此文档。如欲获取此数据表的浏览器版本，请参阅左侧的导航。

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TVS3300DRVR	Active	Production	WSON (DRV) | 6	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	17JH
TVS3300DRVR.A	Active	Production	WSON (DRV) | 6	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	17JH
TVS3300DRVRG4	Active	Production	WSON (DRV) | 6	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	17JH
TVS3300DRVRG4.A	Active	Production	WSON (DRV) | 6	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	17JH
TVS3300YZFR	Active	Production	DSBGA (YZF) | 4	3000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 125	15K
TVS3300YZFR.A	Active	Production	DSBGA (YZF) | 4	3000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 125	15K

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

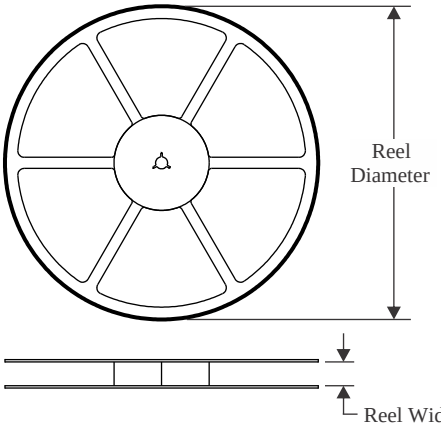
Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

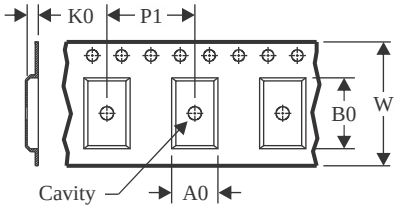
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

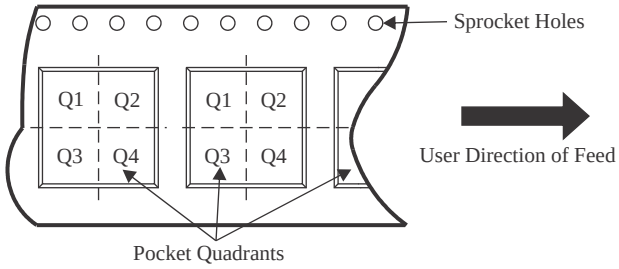


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

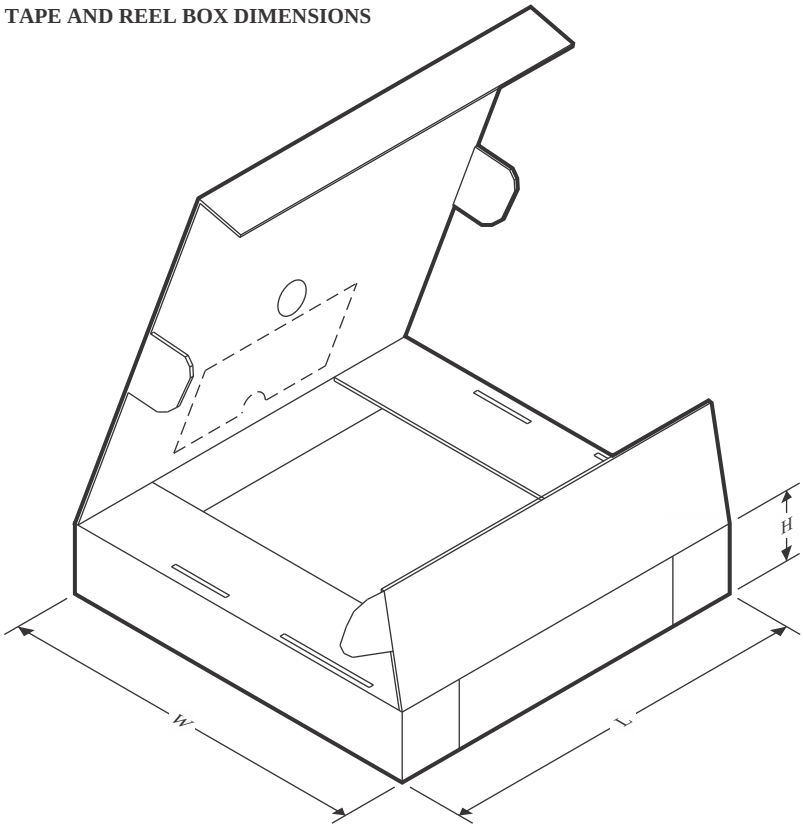
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TVS3300DRVR	WSON	DRV	6	3000	180.0	8.4	2.3	2.3	1.15	4.0	8.0	Q2
TVS3300DRVRG4	WSON	DRV	6	3000	180.0	8.4	2.3	2.3	1.15	4.0	8.0	Q2
TVS3300YZFR	DSBGA	YZF	4	3000	180.0	8.4	1.17	1.22	0.72	2.0	8.0	Q1

TAPE AND REEL BOX DIMENSIONS

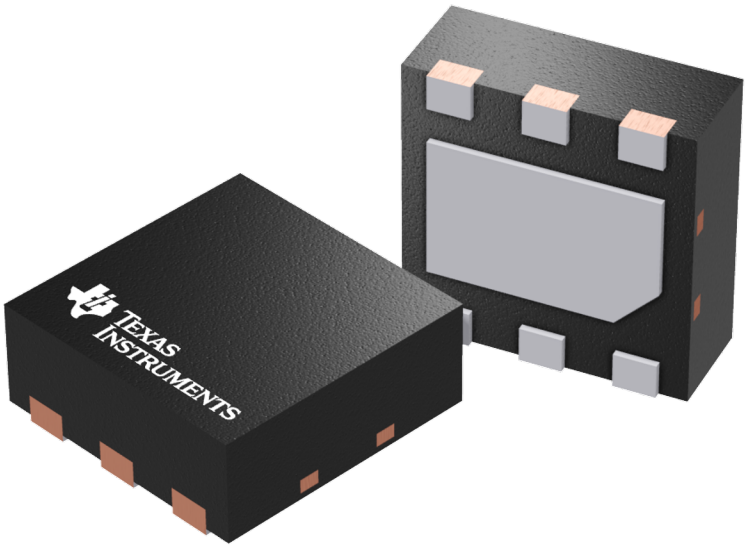


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TVS3300DRVR	WSON	DRV	6	3000	210.0	185.0	35.0
TVS3300DRVRG4	WSON	DRV	6	3000	210.0	185.0	35.0
TVS3300YZFR	DSBGA	YZF	4	3000	182.0	182.0	20.0

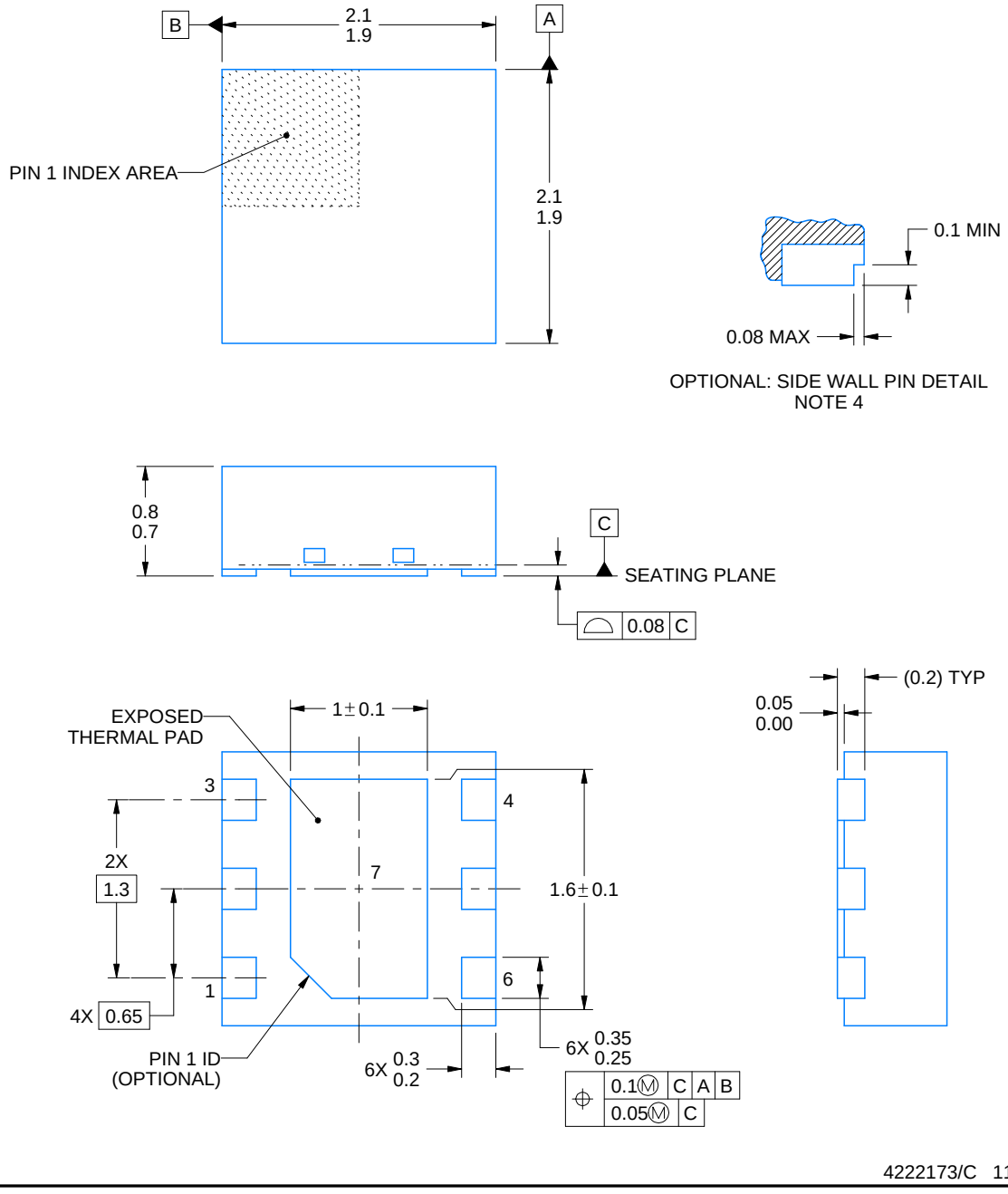
DRV 6 WSON - 0.8 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



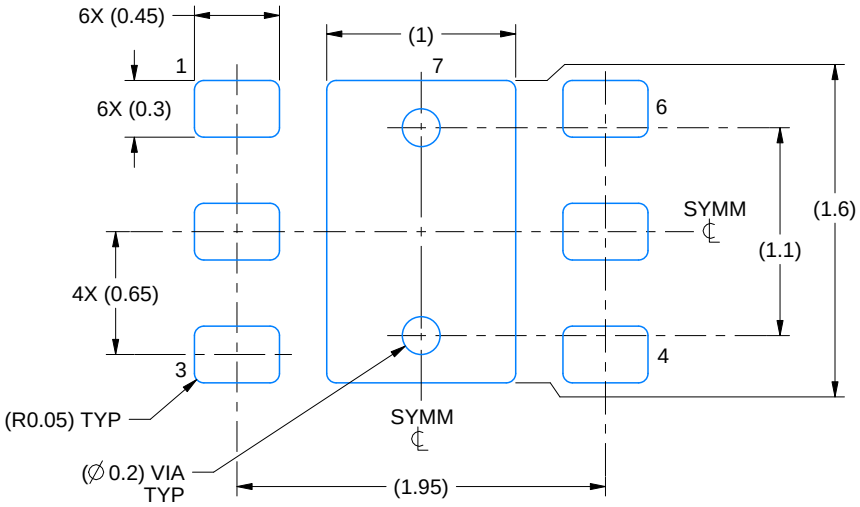
Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

PLASTIC SMALL OUTLINE - NO LEAD

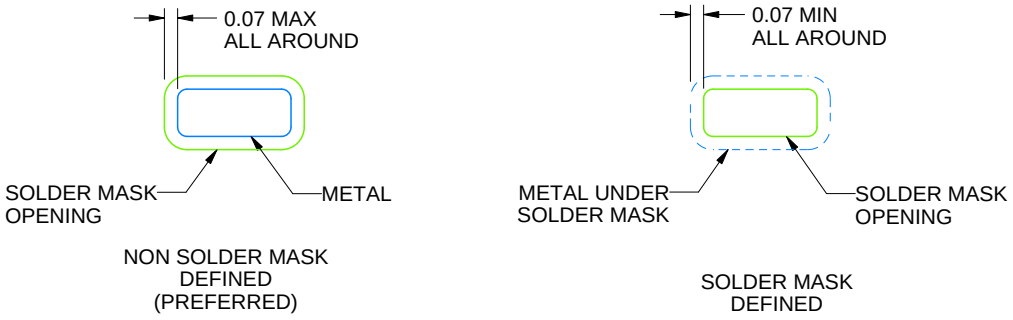


NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.
4. Minimum 0.1 mm solder wetting on pin side wall. Available for wettable flank version only.



LAND PATTERN EXAMPLE
SCALE:25X

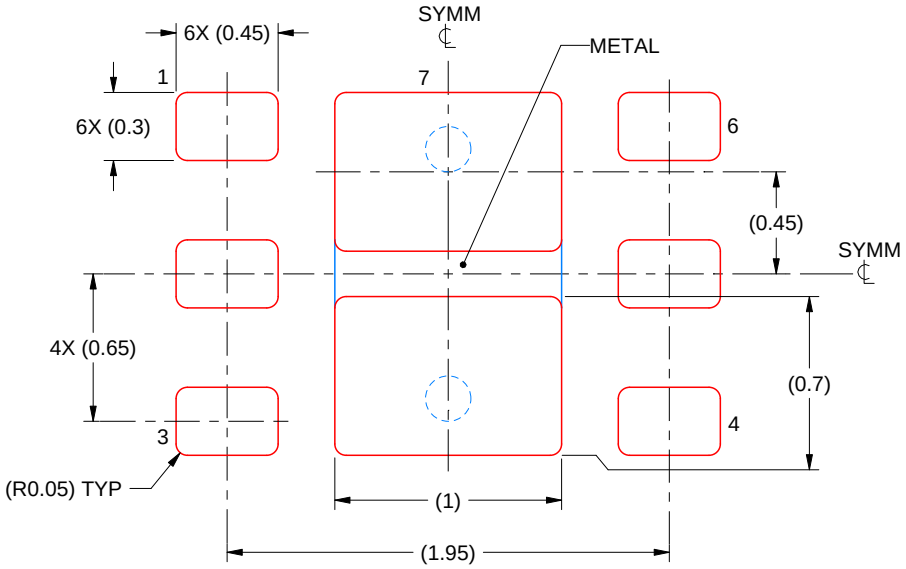


SOLDER MASK DETAILS

4222173/C 11/2025

NOTES: (continued)

5. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).
6. Vias are optional depending on application, refer to device data sheet. If some or all are implemented, recommended via locations are shown.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD #7
88% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE
SCALE:30X

4222173/C 11/2025

NOTES: (continued)

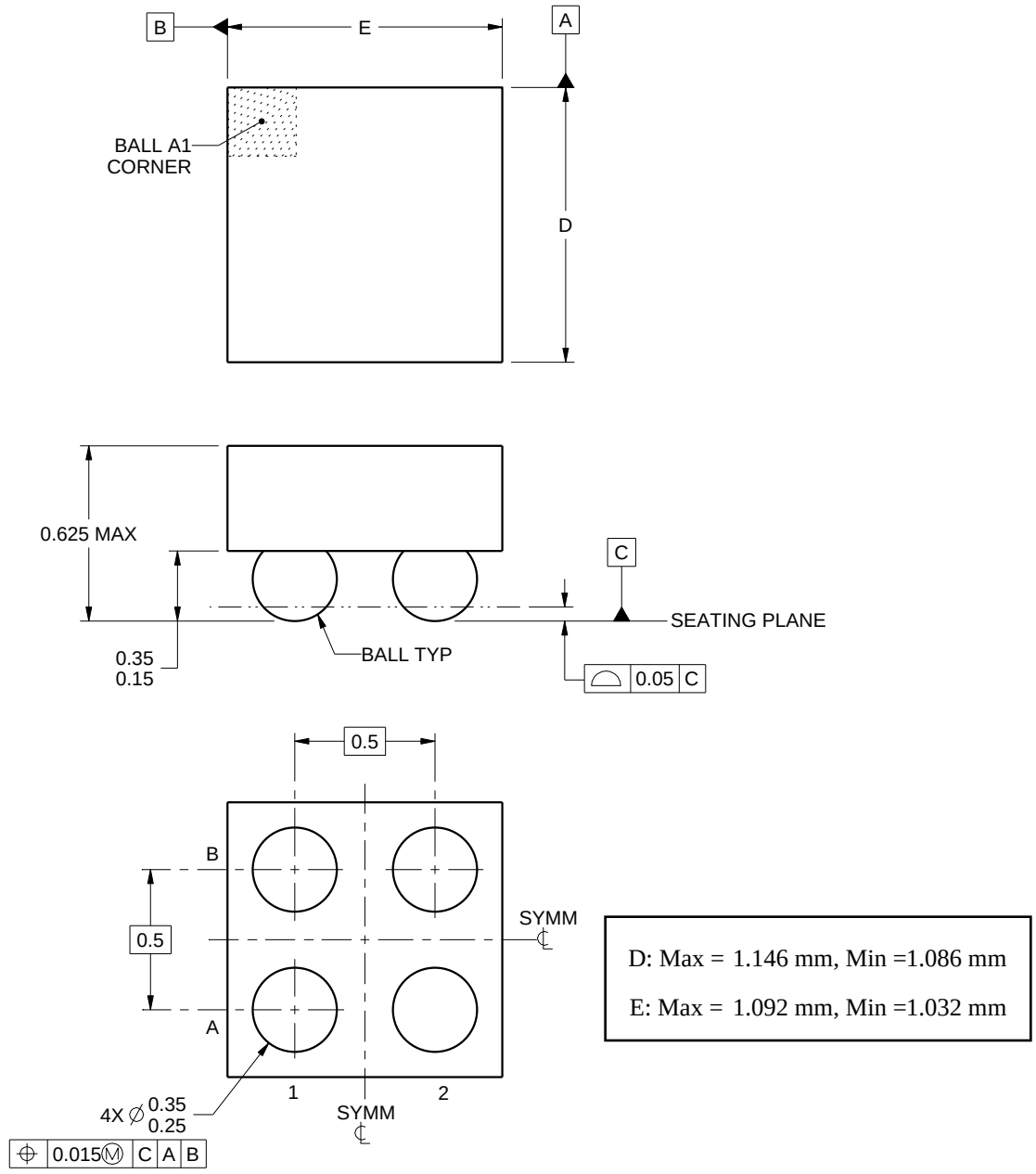
7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

PACKAGE OUTLINE

YZF0004

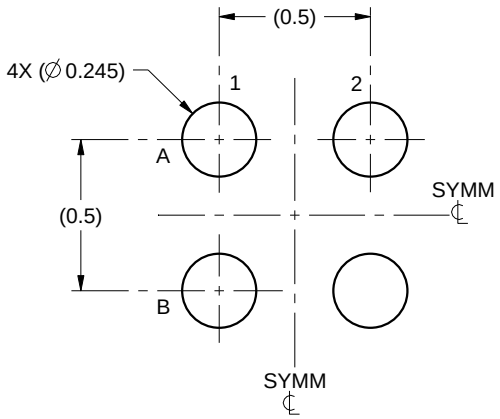
DSBGA - 0.625 mm max height

DIE SIZE BALL GRID ARRAY

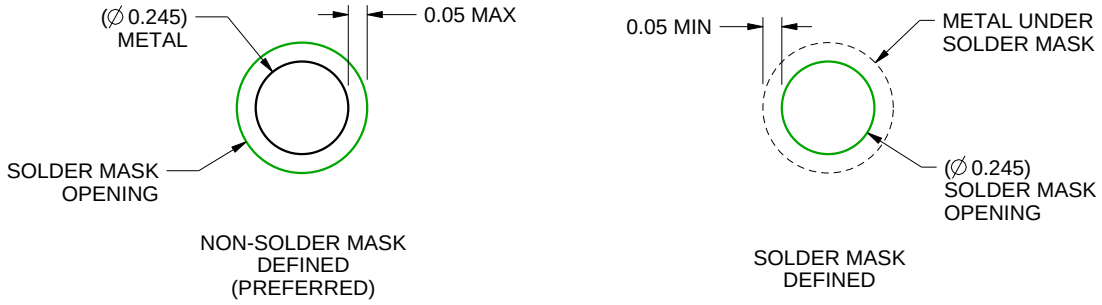


NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.



LAND PATTERN EXAMPLE
SCALE:40X



SOLDER MASK DETAILS
NOT TO SCALE

4223221/A 08/2016

NOTES: (continued)

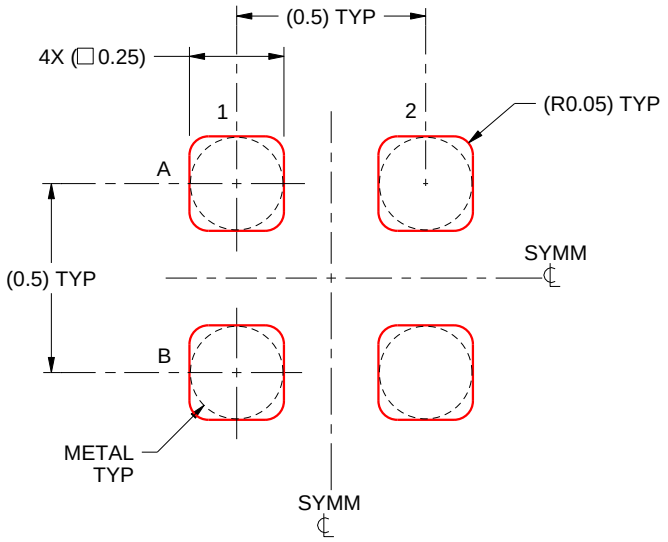
3. Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints.
   See Texas Instruments Literature No. SNVA009 (www.ti.com/lit/snva009).

EXAMPLE STENCIL DESIGN

YZF0004

DSBGA - 0.625 mm max height

DIE SIZE BALL GRID ARRAY



SOLDER PASTE EXAMPLE
BASED ON 0.1 mm THICK STENCIL
SCALE:50X

4223221/A 08/2016

NOTES: (continued)

4. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release.

重要通知和免责声明

TI“按原样”提供技术和可靠性数据（包括数据表）、设计资源（包括参考设计）、应用或其他设计建议、网络工具、安全信息和其他资源，不保证没有瑕疵且不做出任何明示或暗示的担保，包括但不限于对适销性、与某特定用途的适用性或不侵犯任何第三方知识产权的暗示担保。

这些资源可供使用 TI 产品进行设计的熟练开发人员使用。您将自行承担以下全部责任：(1) 针对您的应用选择合适的 TI 产品，(2) 设计、验证并测试您的应用，(3) 确保您的应用满足相应标准以及任何其他安全、安保法规或其他要求。

这些资源如有变更，恕不另行通知。TI 授权您仅可将这些资源用于研发本资源所述的 TI 产品的相关应用。严禁以其他方式对这些资源进行复制或展示。您无权使用任何其他 TI 知识产权或任何第三方知识产权。对于因您对这些资源的使用而对 TI 及其代表造成的任何索赔、损害、成本、损失和债务，您将全额赔偿，TI 对此概不负责。

TI 提供的产品受 TI 销售条款)、TI 通用质量指南 或 ti.com 上其他适用条款或 TI 产品随附的其他适用条款的约束。TI 提供这些资源并不会扩展或以其他方式更改 TI 针对 TI 产品发布的适用的担保或担保免责声明。 除非德州仪器 (TI) 明确将某产品指定为定制产品或客户特定产品，否则其产品均为按确定价格收入目录的标准通用器件。

TI 反对并拒绝您可能提出的任何其他或不同的条款。

版权所有 © 2026，德州仪器 (TI) 公司

最后更新日期：2025 年 10 月